

Distributed Learning - Diagnostic, Advisement, and Technical
Research (DL DART) Support Services

Chemical, Biological, Radiological, and Nuclear (CBRN)
Basic Radiological Defense Course

Sharable Content Object Reference Model (SCORM) Application
Programming Interface (API) Usage in Assessments

Functional Analysis Report

Version 1.0

Provided for

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(TCM TADLP)



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Version History

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1.0	05 June 2015	Initial release

Introduction

This document provides information regarding the Sharable Content Object Reference Model (SCORM) Application Programming Interface (API) SCORM API usage within Chemical, Biological, Radiological, and Nuclear (CBRN) Basic Radiological Defense Course (hereafter referred to as CBRN) assessment content for informative use, and additionally offers a conclusion as to whether the SCORM API usage within assessment content effects rollup failures through resulting network activity. The document includes a listing of SCORM API usage throughout CBRN assessments from the time an assessment Shareable Content Object (SCO) launches on the ALMS until the learner exits the assessment.

Assessment SCORM API Usage

SCORM API usage during run-time can be organized into five categories of learner action:

1. Launching the SCO
2. Beginning the assessment
3. Selecting an answer to a question
4. Submitting the completed assessment
5. Exiting the assessment

The following sections of this document discusses each of these categories. Each category contains an outline of SCORM API usage, with additional information provided when necessary for clarification. See Appendix A for a complete log of SCORM API activity.

Launching the SCO

A set of initial SCORM calls are made to initialize the activity and retrieve data about the assessment and environment when the SCO is launched. The sequence of SCORM API usage is outlined below:

- 1. Initialize method is called**
- 2. Retrieval of launch data from the manifest**
The `cmi.launch_data` data model element is retrieved based on the `adlcp:dataFromLMS` element value in the manifest, identifying an XML data file for use by the content.
- 3. Retrieval of completion status, content status, and learner information**
The content attempts to retrieve any prior completion status and suspend data along with the learner ID and content credit and mode values.
- 4. Commit method is called**

Beginning the Assessment

Following the introduction page, the learner begins the assessment which retrieves and sets assessment data such as objective information, interaction information, and scoring information. The sequence of SCORM API usage is outlined below:

- 1. Retrieval of objective information**

The number of objectives and their IDs are retrieved at the beginning of the assessment based on objective data in the manifest.

- 2. Interaction IDs and weighting are set**

Interaction data is set based on information within the assessment data file identified in the manifest.

- 3. Retrieval of the passing score**

The score required to pass is set based on information within the assessment data file identified in the manifest.

- 4. Assessment scoring information and interaction weightings are set**

Question weightings, the maximum score, and the minimum score are set based on information within the assessment data file identified in the manifest.

- 5. Commit method is called**

Selecting an Answer to a Question

Data for a particular interaction, such as timing and type, is set when a learner selects an answer; repeat this process for each question in the assessment. The sequence of SCORM API usage is outlined below:

- 1. Interaction data is set**

Interaction data model elements for type, latency, learner response, result, response pattern, and timestamp are set.

- 2. Commit method is called**

Submitting the Completed Assessment

The learner submitting the completed assessment retrieves the assessment scoring information and sets the initial success and completion status. The content retrieves and sets objective information immediately afterward. Finally, the calculated score is set alongside the completion status. The sequence of SCORM API usage is outlined below:

- 1. Retrieval of passing score and max score**

The maximum score and passing scores are retrieved based on information within the assessment data file identified in the manifest, for use by the content in evaluating learner performance.

- 2. Completion and success statuses set to initial values**

Completion and success statuses are set to initial values prior to evaluation of learner performance.

- 3. Objective information is set**

Objective information is set based on information within the assessment data file identified in the manifest and evaluation of learner performance.

4. Calculated score information is set

Raw and scaled scores are calculated and set based on learner performance.

5. Commit method is called

6. Completion status is set

Completion status is set based on the type of the assessment (pretest or posttest) and the success status.

Exiting the Assessment

The total session time is set and a navigation request and value for the `cmi.exit` data model element are set when the learner exits the content as instructed. The content looks up learner and assessment information before finally calling the `Commit` and `Terminate` methods.

1. Total session time is set

The total time between the beginning of the assessment and the time at which the learner exited the assessment is calculated and set.

2. Navigation request is retrieved and set

The content looks for a previous navigation request and sets one to request an action from the LMS once the `Terminate` method is called if a navigation request does not already exist.

3. The `cmi.exit` data model element is set

The exit status for the content is set to notify the LMS how the learner exited the content.

4. Retrieval of learner ID, completion statuses and raw score

The LMS retrieves the learner ID, completion statuses for primary objectives, and the content as a whole, and the raw score prior to termination.

5. Commit method is called

6. Terminate method is called

Conclusion

The DL DART Team concludes that CBRN assessment content is not effecting issues related to network performance during run-time. The conclusion is based upon analysis of SCORM API usage through the beginning to end stages of assessment content as outlined in this document. CBRN assessment content exhibits the following standard behavior with regard to utilization of SCORM:

- Initialization and termination of SCORM connection
- Retrieval of data model elements to determine preexisting values prior to initialization of these elements
- Initialization of data model elements using both default values and values pulled from data identified in the manifest
- Persistence of data model element values following logical groups of values being set
- Status data model elements (i.e., completion and success statuses) explicitly set for individual objectives identified in the manifest
- Avoidance of multiple large groupings of SCORM API method calls
- All GetValue and SetValue method calls return either 0 or 403 error codes
- Navigation request and exit status to effect LMS actions set prior to termination

Analysis of the overall behavior of course content concludes that no violation of the behavior above occurs; therefore, no risk of failure exists through incorrect statuses during rollup as a result of SCORM run-time behavior.

Appendix A: SCORM API Log Output

This appendix contains a log output of SCORM API activity generating using the ADL SCORM 2004 Sample Run-time Environment software.

Note: The section headings below are not part of the original log output. Each heading is included to logically separate groups of API activity, as well as state the number of GetValue and SetValue method calls in each group for clarity.

Launching the SCO (13 Get, 0 Set)

Called Initialize

Initialize Returned Error Code 0

Called GetValue(cmi.launch_data)

GetValue Returned the value services/xmldata/tst_35d6848f-1310-4c30-95f3-bf3370471224.xml

Called GetValue(cmi.launch_data)

GetValue Returned the value services/xmldata/tst_35d6848f-1310-4c30-95f3-bf3370471224.xml

Called GetValue(cmi.completion_status)

GetValue Returned the value unknown

Called GetValue(cmi.learner_id)

GetValue Returned the value admin

Called GetValue(cmi.suspend_data)

GetValue Returned the value

GetValue Returned Error Code 403

Called GetValue(cmi.suspend_data)

GetValue Returned the value

GetValue Returned Error Code 403

Called GetValue(cmi.suspend_data)

GetValue Returned the value

GetValue Returned Error Code 403

Called GetValue(cmi.credit)

GetValue Returned the value credit

Called GetValue(cmi.mode)

GetValue Returned the value normal

Called GetValue(cmi.completion_status)

GetValue Returned the value unknown

Called GetValue(cmi.completion_status)

GetValue Returned the value unknown

Called GetValue(cmi.completion_status)

GetValue Returned the value unknown

Called GetValue(cmi.mode)

GetValue Returned the value normal

Called Commit

Commit Returned Error Code 0

Exam Init (14 Get, 12 Set)

Called GetValue(cmi.objectives._count)

GetValue Returned the value 1

Called GetValue(cmi.objectives.0.id)

GetValue Returned the value PRIMARY_OBJ

Called GetValue(cmi.objectives.__count)

GetValue Returned the value 1

Called SetValue(cmi.interactions.0.id, 8c4b7da0-5138-4a77-811a-ac34f33c1481)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.1.id, ef6a4500-3553-4948-a132-1276a0ab1c5a)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.2.id, bd3eaa59-124c-4aeb-af30-abe943bbd153)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.3.id, 5af5c676-0cda-4ed4-96e7-9c76547c5d24)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.4.id, edc51f9b-0ef6-47b8-96bb-e45bc21736df)

SetValue Returned Error Code 0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called SetValue(cmi.interactions.0.weighting, 1)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.1.weighting, 1)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.2.weighting, 1)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.3.weighting, 1)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.4.weighting, 1)

SetValue Returned Error Code 0

Called SetValue(cmi.score.max, 100)

SetValue Returned Error Code 0

Called SetValue(cmi.score.min, 0)

SetValue Returned Error Code 0

Called GetValue(cmi.location)

GetValue Returned the value

GetValue Returned Error Code 403

Select answer (0 Get, 6 Set)

Called SetValue(cmi.interactions.0.type, choice)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.0.latency, PT00H00M33.34S)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.0.learner_response, 3)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.0.result, incorrect)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.0.correct_responses.0.pattern, 1)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.0.timestamp, 2015-06-01T09:45:47.5)

SetValue Returned Error Code 0

Called Commit

Commit Returned Error Code 0

Submit (27 Get, 21 Set)

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.score.max)

GetValue Returned the value 100

Called SetValue(cmi.success_status, passed)

SetValue Returned Error Code 0

Called SetValue(cmi.completion_status, completed)

SetValue Returned Error Code 0

Called GetValue(cmi.objectives._count)

GetValue Returned the value 1

Called GetValue(cmi.objectives.0.id)

GetValue Returned the value PRIMARY_OBJ

Called SetValue(cmi.objectives.0.success_status, passed)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.0.completion_status, completed)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.0.score.scaled, 0.4)

SetValue Returned Error Code 0

Called GetValue(cmi.objectives._count)

GetValue Returned the value 1

Called SetValue(cmi.interactions.0.objectives.0.id, f1dea54b-fb9d-4f29-9fb4-9d488bada50e)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.1.objectives.0.id, f1dea54b-fb9d-4f29-9fb4-9d488bada50e)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.2.objectives.0.id, f1dea54b-fb9d-4f29-9fb4-9d488bada50e)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.3.objectives.0.id, f1dea54b-fb9d-4f29-9fb4-9d488bada50e)

SetValue Returned Error Code 0

Called SetValue(cmi.interactions.4.objectives.0.id, f1dea54b-fb9d-4f29-9fb4-9d488bada50e)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.0.id, PRIMARY_OBJ)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.1.id, f1dea54b-fb9d-4f29-9fb4-9d488bada50e)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.1.score.raw, 40)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.1.score.scaled, 0.4)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.1.score.max, 100)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.1.score.min, 0)

SetValue Returned Error Code 0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.scaled_passing_score)

GetValue Returned the value 1.0

Called GetValue(cmi.objectives.1.score.max)

GetValue Returned the value 100

Called SetValue(cmi.objectives.1.success_status, failed)

SetValue Returned Error Code 0

Called SetValue(cmi.objectives.1.completion_status, completed)

SetValue Returned Error Code 0

Called GetValue(cmi.completion_status)

GetValue Returned the value completed

Called SetValue(cmi.score.scaled, 0.4)

SetValue Returned Error Code 0

Called SetValue(cmi.score.raw, 40)

SetValue Returned Error Code 0

Called Commit

Commit Returned Error Code 0

Called SetValue(cmi.completion_status, completed)

SetValue Returned Error Code 0

Called GetValue(cmi.completion_status)

GetValue Returned the value completed

Terminate (6 Get, 4 Set)

Called SetValue(cmi.session_time, PT0000H04M08.69S)

SetValue Returned Error Code 0

Called GetValue(cmi.completion_status)

GetValue Returned the value completed

Called GetValue(adl.nav.request)

GetValue Returned the value _none_

Called SetValue(adl.nav.request, exit)

SetValue Returned Error Code 0

Called SetValue(cmi.exit, suspend)

SetValue Returned Error Code 0

Called GetValue(cmi.learner_id)

GetValue Returned the value admin

Called GetValue(cmi.objectives.1.completion_status)

GetValue Returned the value completed

Called GetValue(cmi.score.raw)

GetValue Returned the value 40

Called GetValue(cmi.completion_status)

GetValue Returned the value completed

Called SetValue(cmi.completion_status, completed)

SetValue Returned Error Code 0

Called Commit

Commit Returned Error Code 0

Called Commit

Commit Returned Error Code 0

Called Terminate

Terminate Returned Error Code 0